

# APEX tests for p-Au run

C. Liu

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# Outline

- P-A run planning status
- APEX tests for p-A run
- Preparations for the tests

# P-A run planning status

- **Movement of components demanded by p-A beam trajectories:** DXs at IR2 moved by 20 mm, IR4 moved by 17.5 mm. All others except 6, 7 and 8 were test-moved. All others will be moved between pp and p-A. 9 MHz cavity moved. STAR beam pipes inspected and loose RF fingers fixed. STAR beam pipe surveyed and 7 mm horizontal offset at one end of the Be pipe discovered, fixed. Questions related to RP and ZDC settled. DX-D0 chambers at IR6&8 to be moved between pp and p-A.
- **Acceleration ramp:** Au mini-ramp tested successfully. Proton ramp needs to be lengthened ~2 times. Effects on polarization?

# Test 1: orbit scan at IR6&8

- 7 mm vertical offset of STAR Be pipe was found in 2013! 7 mm horizontal offset was found in Dec, 2014!! What else?
- Scan p beam by position bumps in both planes, ~15 mm scan range is expected in either direction.

# Test 2: He beam background

- In He-Au run, background at injection and early part of the ramp was caused by He beam. Is it fixed by realignment of STAR pipe?
- Put proton beam on He-3 trajectory, see if problem disappears.

# Test 3: Proton trajectories at IR2&4

- DX magnets moved in IR2 and 4 before pp.
- Put proton on p-Au trajectories at injection, watch possible aperture limit at DXs and DX-D0 chamber.

# Test 4: Au trajectory at IR2&4

- Put Au beam on p-Au trajectory at injection at IR2&4, watch possible aperture limit at DX and DX-D0 chamber.

# Test 5: DX aperture scan

- Before shutdown, only IR6&8 DXs were planned to be moved. DX aperture scan was not done for all Dxs.
- Angle scan both p beams at all IRs, check if the scan range in either direction equal, how much they are.



# Test 6: Au beam offset at D0s

- With horizontal Au beam offset at D0s, the physical aperture limits at DXs and DX-D0 chamber would be relaxed.
- Exercise putting Au beam off D0 center by 10 mm at all IRs. Script D0offset.py for calculating corrector strengths and beam position at BPMs is ready to be tested.

# Test 7: slower p ramp

- For 100 GeV pp ramp (pp12a-v1), the dipole ramp (to  $\sim 2000$  A) takes 135 s. In pAu15-e0, the dipole ramp will take 260 s because it takes longer for Yellow ring (Au) to reach high field (to  $\sim 5000$  A) .
- Ramp proton at slow factor 2 with pp ramp, check any effect on polarization.

# Test 8: unequal $f_{\text{rev}}$ test

- We should make thing as simple, easy as possible for p-Au operation. Ramp with unequal  $f_{\text{rev}}$ , if works, would simplify operation procedure, relieve aperture limit, keep p and Au ramp independent, save time...
- Increase separation bump (to 20 mm), IRbumps.py is ready to be tested. Superior beam control should help reduce beam loss as demonstrated at injection last year. Quick test at injection first.

# Summary

Index	Test	beam	D0 shunt flip	Time (h)
1	Orbit scan	p	No	1
2	proton on He orbit	p	Yes	1
3	Proton trajectories at IR2&4	p	No	2
4	Au trajectories at IR2&4	Au	Yes	2
5	DX aperture scan	p	No	4
6	Au beam offset at D0s	Au	Yes	2
7	Slower p ramp	p	No	2
8	unequal f_rev test	p, Au	Yes	4

# Au setup in AGS

- We would like to have Au beam available asap so tests can be done whenever time is available.
- Au setup will be scheduled around 5<sup>th</sup>, Jan in AGS (Haixin).